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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Mechanism for Moving Vertically and Tilting Longitudinally the Frame Supporting the Mattress of a Bed

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Mechanism for moving vertically and tilting longitudinally the frame supporting the mattress of a bed

ABSTRACT

Mechanism for moving vertically and tilting longitudinally the frame supporting the mattress of a bed consisting of a lower frame (1) and an upper frame (2) whose side members (11, 21) are connected by two pairs of identical struts (3, 5 and 4, 6) hinged centrally to each other with their inner ends hinged to the centre of these (11, 21) while their outer ends are engaged slidingly in a guided manner in the outer ends. The upper frame (2) can thus be moved vertically, with the weight that presses down on it being balanced by suitable springs (7), and can be tilted longitudinally, with the outer portions (3b and 4b) of the struts (3 and 4) engaged in the side members (21) being so arranged that they can rotate about the central hinge point of their respective pair (3, 5 and 4, 6); means of locking the upper frame in the desired positions being provided.

MECHANISM FOR MOVING VERTICALLY AND TILTING LONGITUDINALLY THE FRAME SUPPORTING THE MATTRESS OF A BED

The subject of the present invention is a special mechanism that can be fitted to the frame supporting the mattress of a bed in order to enable it to be easily moved vertically and tilted longitudinally simply by means of straightforward, easy manual actions.

There have long been a great variety of systems for lifting and/or lowering the frame carrying the mattress of a bed, and others for tilting it longitudinally in order to offer the user comfortable and helpful positions especially in the case of patients suffering from certain diseases.

Some of these known systems employ a variety of more or less complicated mechanisms operated either by hand power or by suitable devices, usually electromechanical.

Hand-powered mechanisms, though normally relatively simple, are generally operated through a crank which is usually located in awkward positions, making it difficult and inconvenient to use.

Mechanisms powered by electromechanical devices, on the other hand, though being simple and convenient to operate, are clearly not only complicated but also very costly and can give problems such as non-operation if the electricity supply is interrupted and all kinds of possible failures of the various components.

The object of the present invention is to overcome the problems indicated above and this is achieved with a mechanism forming the subject of the present invention, which, the better to explain its operation, is here described below in detail, purely by way of a non-restrictive example, with reference to the accompanying drawings which show schematically, in a series of figures in side view, the configuration of the mechanism and its operation. Specifically:

- Fig. 1 shows the mechanism in the position in which the frame that supports the mattress is set

horizontally in its raised position;

- Fig. 2 shows the same mechanism in the position in which the frame that supports the mattress is set horizontally in a lowered position;

- Fig. 3 shows an intermediate position similar to the above two;

- Figures 4, 5 and 6 are enlarged partial views of the detail of the device for moving the mattress supporting frame up and down and locking it in the desired position, more specifically in the raised position of Fig. 1, in the intermediate position of Fig. 3 and in the lowered position of Fig. 2;

- Figures 7 and 8 show the mechanism in the raised position illustrated in Fig. 1 with the mattress supporting frame tilted longitudinally in opposite directions in each figure; and

- Figures 9 and 10 are enlarged partial views of the detail of the device for tilting the mattress supporting frame in opposite directions, Fig. 9 in the locked position and Fig. 10 in the released position.

With reference to these figures, in which repeated details are given the same references, it will be seen that the mechanism that forms the subject of the present invention consists fundamentally of a lower frame 1 and an upper frame 2 connected to each other by a structure which will be described in detail later, all the parts making up said mechanism being made of suitable metal components.

Said lower frame 1 and said upper frame 2 are more or less identical to each other and will consist, in a manner known per se, of respective rectangular frames made up of suitable square- or rectangular-sectioned metal tubes, of which the figures referred to show only their two respective longitudinal members 11 and 21 located on one side, partly split as appropriate.

The lower frame 1 will stand on the floor S on suitable feet P and the upper frame 2 will be connected above in some appropriate way to the frame T supporting the mattress M by means of suitable connecting parts C.

There now follows a description firstly of the construction and operation of the fundamental part of the structure of the mechanism that makes it possible to move and position the frame 2 vertically, and then of that part of the structure that makes it possible to achieve longitudinal tilt and positioning of the same.

In Figures 1, 2 and 3 it will be seen that the fundamental part of the structure of the mechanism is constructed as follows.

At the centre of the two longitudinal members 11 located along the sides of the lower frame 1, there are hinged, to one side of these members, the ends of two struts 3 and 4. The other ends of these struts engage slidingly in a guided manner near the ends of the corresponding longitudinal members 21 located along the sides of the upper frame 2. At the centre of the two longitudinal members 21 located along the sides of the upper frame 2 there are hinged, again to one corresponding side of these members, the ends of two more struts 5 and 6. The other ends of these struts engage slidingly in a guided manner near the ends of the longitudinal members located along the sides of the lower frame 1.

The struts 3, 4, 5 and 6 are all identical and the two pairs formed by struts 3, 5 and by struts 4, 6 that are arranged symmetrically to each other about the hinged points in the centres of the respective longitudinal members 11 and 21, are hinged centrally to each other.

The outer ends of said struts 3, 4, 5 and 6 will be provided with suitable rollers or blocks 31, 41, 51, 61 for guided longitudinal movement along the inside of their respective quadrilateral sections or in suitable tracks so that they can freely be slid in and out. Suitable longitudinal slots will of course be provided in the sections 11 and 21 along the respective slide segments (or in the equivalent tracks provided in these segments) in order to allow the associated spindles to pass along.

This clearly gives a deformable structure that will allow the two frames 1 and 2 to be moved towards and/or away from each other in parallel planes.

The outer ends of the struts 5 and 6 are also engaged by means of suitable pins 52, 62 in the outer ends of respective return springs 7 whose other ends are attached in turn to other respective anchoring means 71, 72 mounted further in on their longitudinal members 11.

Said return springs 7 will be designed to provide corresponding tensions directed towards the centre which clearly, given the configuration of the structure described, will produce at the central hinged point of the longitudinal sections 21 of the upper frame 1 a vertical upward force sufficient to balance the weight pressing down on the frame 1 which, as a whole, is the sum of the weights of the frame 1 itself, the frame T, the mattress M and any sheets, blankets, etc. arranged on the latter (T).

The outer ends of two fixing bars 13 and 14 are also attached to the outer ends of said struts 5 and 6, or rather to the pins of the latter's rollers or to the equivalent sliding blocks 51, 61. These fixing bars 13 and 14 consist of respective rectangular plates arranged in line along the section forming the respective longitudinal member 11 and their other or inner ends are suitably contained, and slide in a guided manner, in a suitable housing 15, with two segments positioned side by side and provided, on their upper surfaces, with a number of notches capable of engaging the tooth formed on the free end of a pawl 8 which at its other end is connected to a suitable actuating lever 82 which is also hinged to a bracket 81 mounted on top of the longitudinal members 11.

A suitable return spring (not shown) will of course be provided to push said pawl 8 and hence its tooth projecting from its free end so that it engages in the notches formed on the terminal segments of the inner ends of said fixing bars 13 and 14.

Figures 4, 5 and 6 clearly illustrate the detail

of the assembly used, as described above, for locking and releasing the present mechanism when set respectively in the fully up position, the intermediate position and the fully down position, and here the pawl 8 and its actuating lever 82 are indicated in heavy continuous lines in the locked position and in thin chain lines in the released position.

It will be obvious that so long as the tooth of the pawl 8 is engaged in two cavities, one from each of the adjacent segments of said fixing bars 13 and 14, the entire structure will be locked in position with no possibility of movement of said fixing bars 13 and 14, so that the frame 2 and anything on it cannot move vertically.

If now the lever 82 is acted on to rotate the pawl 8 as illustrated in thin chain lines in Figures 4, 5 and 6 in the direction of disengagement of its tooth from the notches in which it was positioned, said fixing bars 13 and 14 will be free to slide and the entire structure formed by the pairs of crossed struts 3, 5 and 4, 6 uniting the two frames, lower 1 and upper 2, can now be deformed to move the latter towards and/or away from each other in parallel planes or more precisely allowing the upper frame 2 to move vertically with respect to the lower frame 1.

Because of the balancing action of the springs 7, when the locking device represented by the pawl 8 is disengaged from the fixing bars 13 and 14, the operator will only need to apply a gentle push upwards or downwards to raise or lower the upper frame 2 and anything that may be on it.

The bed can thus be moved from the raised position shown in Fig. 1 to the lowered position shown in Fig. 2 and vice versa, passing through all the possible intermediate positions on the way, of course.

In the embodiment illustrated, said fixing bars 13 and 14 are each provided, on their respective adjacent segments located at their inner ends, and in which the locking pawl 8 tooth acts, with three notches set out at

suitable distances from each other so that said tooth, when placed in the first notches, which are those formed towards their respective ends, fixes the structure in the raised position shown in Fig. 1, whereas when placed in the next, more inner notches, it fixes the structure in the intermediate position shown in Fig. 3, and lastly, when placed in the still more inner notches next after the last, it fixes the structure in the lowered position shown in Fig. 2.

Clearly, it will be possible to provide a greater number of notches on said fixing bars 13 and 14 so that a corresponding greater number of relative positions between said lower and upper frames 1 and 2 can be obtained.

Having thus described the configuration of that part of the device which enables the upper frame 2 to be raised and lowered, as well as its operation, the description now turns, with particular reference to Figures 7, 8, 9 and 10, to the configuration and operation of that part of the mechanism which enables it, whatever its vertical position, to be tilted longitudinally in opposite directions and set at the desired angle.

In the embodiment to which reference is being made, the ability to tilt said upper frame 2 is made possible by dividing the two struts 3 and 4 into two halves exactly where they are hinged centrally to the corresponding struts 5 and 6, thus forming two inner portions 3a, 4a and two outer portions 3b, 4b identical to each other and hinged at their hinged central ends to the centre of the corresponding struts 5 and 6.

Assuming the structure formed by the struts 5 and 6 to be fixed in one possible position as already described, namely the raised position in the case illustrated in Figures 7, 8, 9 and 10, it will be clear that said outer portions 3b and 4b of the corresponding struts 3 and 4 can rotate freely about their hinged points at the corresponding ends of the inner portions 3a, 4a and at the centres of the struts 5 and 6 and

consequently the upper frame 2 can pivot freely about its central point hinged to the upper ends of the struts 5 and 6, thus being tilted freely in opposite directions. In order that the upper frame 2 can be locked in the desired tilted position, the hinged ends of the outer portions 3b and 4b are continued in the form of two short arms 3c and 4c extending inwards while also bending somewhat downwards, and to the free ends of said short segments 3c and 4c there are hinged, at their lower ends, two shaped plates 31 and 32 leading generally upwards, i.e. towards the upper frame 2. These plates are also each additionally hinged in turn - at a point located on themselves intermediate between the points where their lower ends hinge on the free ends of said short arms 3c and 4c and the points where the corresponding outer portions 3b and 4b of the struts 3 and 4 hinge on the centres of the struts 5 and 6 - to the outer ends of two other mutually identical actuating links 91 and 92, the inner ends of which are then hinged to the free end of an actuating arm 93 which in turn is hinged to the centre of the respective longitudinal member 21 of the upper frame 2, that is to say in practice coaxially with the central pins about which the struts 5 and 6 are hinged.

Said actuating arm 12 in the rest position is vertical and is continued upwards by the control lever 94. In addition, said shaped plates 31 and 32 as clearly visible in Figures 1 to 7 and in particular much more clearly in Figures 8 and 9, comprise two segments positioned at a moderate distance from their respective intermediate hinged points to which, as stated, the outer ends of the actuating links 91 and 92 are hinged, which segments are also located towards the centre of the entire structure and include a plurality of notches for engagement with respective pins 95, 96 attached integrally to the inner portions 3a and 4a of the struts 3 and 4 towards their outer ends where they are hinged to the corresponding ends of the outer portions 3b, 4b and to the centres of the struts 5 and 6.

Said two shaped plates 31 and 32 are shaped

differently from each other: shaped plate 31 comprises, starting from its hinged point on the arm 3c, a rising segment separate from and somewhat diverging from the segment which is hinged at the bottom to the lower end of the arm 3c and at the top to the outer end of the associated actuating link 91, and its inner edge, namely that turned towards where this plate 31 is hinged to the outer end of the actuating link 91, is provided with said plurality of notches that are engageable on the respective pin 95; whereas shaped plate 32 is generally triangular, its side nearest the centre of the structure being provided with an equivalent plurality of notches for engagement on the respective pin 96.

It will be clear that by moving the control lever 94 from the position of Fig. 9 to that indicated in Fig. 10, the shaped plates 31 and 32 will be pushed, in the case of the first (31) inwards and in the case of the second (32) outwards, so that their respective notches come away from their pins 95 and 96.

Said outer portions 3b and 4b will thus be free to rotate about their respective hinged points on the outer ends of the corresponding inner portions 3a and 4a and about the corresponding central hinged points of the struts 5 and 6, thereby enabling the upper frame 2 to pivot about the central point where it is hinged to the upper ends of said struts 5 and 6. Clearly, pivoting can occur in either direction and when the desired tilt has been reached, the lever 94 is released: it will then be returned to its initial locked position by a suitable return spring (not shown), bringing said shaped plates 31 and 32 back towards their initial positions and their respective notches corresponding to this tilt will engage with the corresponding pins 95, 96. This immobilizes the upper frame 2 and hence the frame T supporting the mattress M in the corresponding tilted position.

It should be pointed out that in the figures referred to only three notches are shown on each shaped plate 31, 32, which means therefore that only three different corresponding positions are possible, namely an

intermediate horizontal position and only two different tilted positions in opposite directions. Obviously, a larger number of notches can be provided in order to offer a corresponding larger number of tilted positions.

From the above account it will be clear that, since the upper frame 2 is hinged centrally to the upper vertex of the structure formed by the struts 5 and 6, which as described above can be locked to the lower frame in various positions to determine the vertical distance between upper vertex and lower frame, forming in effect a non-deformable isosceles triangle making said central hinged point fixed, and since said outer portions 3b and 4b of the struts 3 and 4 are hinged at their inner ends to the centres of the previous struts 5 and 6 and at the corresponding outer ends of their associated inner portions 3a and 4a, while their outer ends can slide freely in a guided manner in said upper frame 2, the latter, when their aforementioned devices for fixing said outer portions 3b and 4b to the respective inner portions 3a and 4a are released as illustrated in Fig. 10, can freely pivot laterally in opposite directions as illustrated in Figures 7 and 8. In this way it is correspondingly tilted in the desired manner and can also be locked in the corresponding appropriate position.

Clearly, this operation can likewise be carried out very simply and easily: the user simply exerts a slight push downwards and upwards at a point external to the central hinged point to bring about a corresponding pivoting of said upper frame 2 along with anything arranged upon it.

It should be pointed out incidentally that the pawls 8 that control the locking and consequent setting of the upper frame 2 in terms of height, and the arms 93 that control its locking and consequent setting in terms of transverse tilt will be situated on both sides of the structure constituting the mechanism in question and each resulting pair will be interconnected by some appropriate transverse connection means such as a suitable metal rod. Also, the respective control levers 82 and 94 can be

attached preferably removably to at least one end of these transverse connection means so that they can be placed on whichever side of the bed is most convenient for the user.

By way of conclusion, the special characteristics of the mechanism forming the subject of the present invention, and the notable advantages achievable therewith are listed below.

In the first place, this mechanism makes it possible to alter, in a highly straightforward and easy manner, with only simple and convenient hand actions, both the height setting and the longitudinal tilt of the entire mattress assembly and associated accessories of a bed.

The structure forming said mechanism is very simple and is easy to fabricate. Its total cost is low and certainly much less than that of the many known mechanisms, especially those in which actuation is by more or less complicated electromechanical or other devices.

Almost no maintenance is required and operation is not only simple but also always very safe and reliable even after long periods of use. No fitting of auxiliary devices of any type, either electromechanical or other, is required.

It will be obvious that many variations may be made of the mechanism forming the subject of the present invention either as regards the construction and configuration of its various components or in terms of possible replacement with equivalent technical means, without however departing from the scope of what has been described above and is claimed below with reference to the accompanying drawings and hence from the scope of protection of the present industrial property.

CLAIMS

1. Mechanism for moving vertically and tilting longitudinally the frame supporting the mattress of a bed, said mechanism consisting of a number of components, all of metal, and comprising fundamentally in a manner known per se a lower frame (1) that stands on suitable feet (P) on the floor (S) and an upper frame (2) that can in itself constitute said frame (T) that supports the mattress (M) or be an independent component to which the mattress (M) supporting frame (T) is fitted, said lower (1) and upper (2) frames being connected to each other by a structure forming, in combination with them, said mechanism and interacting with them in such as way as to enable said upper frame (2) to be moved vertically with respect to the lower frame (1) and also to be tilted longitudinally, said mechanism being characterized in that each of the two longitudinal members (11, 21) located on the sides of the lower (1) and upper (2) frames, respectively, are connected to each other by four struts (3, 4, 5, 6), two of which (3, 4) are hinged at one of their ends to the centre of the longitudinal members (11) of the lower frame (1) and at the other of their ends are engaged near the ends of the longitudinal members (21) of the upper frame (2), along which they can slide longitudinally in a guided manner, while the other two struts (5, 6) are instead hinged at one of their ends to the centre of the longitudinal members (21) of the upper frame (2) and at the other of their ends are engaged near the ends of the longitudinal members (11) of the lower frame (1), along which they can slide longitudinally in a guided manner, the two pairs of struts (3, 5 and 4, 6) that are thus arranged symmetrically and opposite each other with respect to the centre of the lower (1) and upper (2) frames being, in addition, hinged to each other centrally, the resulting structure making it possible for said lower (1) and upper (2) frames to be moved towards and/or away from each other in parallel planes; hence the upper frame (2) can

consequently be moved vertically, consequently enabling the height setting of the mattress (M) to be altered, suitable elastic means such as springs (7) or the like will be fitted as appropriate to said structure to balance the weight pressing down on the upper frame (2) and a suitable hand-operated device for locking said structure and hence the height setting of the upper frame (2) in the desired position, and releasing it to allow its setting to be altered, is provided; furthermore, the two struts (3 and 4) whose inner ends are hinged at the centre of the longitudinal members (11) of the lower frame (1) and whose outer ends are engaged slidingly on the ends of the longitudinal members (21) of the upper frame (2), are divided where their respective central points are hinged to the corresponding struts (5 and 6) of their pairs of struts (3, 5; 4, 6) forming two inner portions (3a, 4a) and two outer portions (3b, 4b), respectively, which two outer portions (3b, 4b), being able to slide at their outer ends along their respective longitudinal members (21) and being free to rotate about the resulting respective hinged points, allow the upper frame (2) itself to rotate about its central point hinged to the corresponding upper ends of the other two struts (5 and 6) and so tilt longitudinally in opposite directions; a suitable hand-operated device also being provided for locking said outer portions (3b, 4b) and hence the upper frame (2) in the desired horizontal or tilted position, and for releasing them to allow its setting to be altered.

2. Device according to Claim 1, characterized in that said devices for locking and/or releasing the structure and thus altering the height setting of said upper frame (2) consist of two fixing bars (13 and 14) arranged in line with the longitudinal member (11) of the lower frame (1) whose outer ends are engaged on the corresponding outer ends of the struts (5 and 6) engaged slidingly in a guided manner in the outer ends of said longitudinal member (11), while their inner ends are contained and guided in a suitable guide housing (15)

fixed to said member (11) with their two respective segments positioned side by side and provided, on their upper surfaces, with a number of notches capable of engaging the tooth formed on the free end of a pawl (8) which is hinged at its other end to a bracket (81), the latter being mounted on the top of said longitudinal member (11) and connected also at this hinged end to a suitable control lever (82) that is operated by hand to disengage and re-engage the tooth of said pawl (8) from and in respective pairs of said notches formed on the inner ends of said fixing bars (13, 14), thus enabling the latter, when disengaged to slide longitudinally and consequently also allow the ends of the associated struts (5 and 6) to slide along, so that said frame (2) can freely be moved vertically to the desired position, and so that, when that position has been reached, the tooth of said pawl (8) can be engaged in a corresponding pair of notches to lock said fixing bars (13, 14) and thus fix the frame (2) in this position.

3. Device according to Claim 1, characterized in that said device for locking the outer portions (3b, 4b) of the respective struts (3, 4) and thereby setting the longitudinal tilt of the upper frame (2) with respect to its centre, consists fundamentally of two short arms (3c, 4c) which, beginning at the inner ends of said outer portions (3b, 4b) where the latter are hinged to the corresponding ends of the corresponding inner portions (3a, 4a) as well as to the centre of the other struts (5, 6), extend inwards while also bending somewhat downwards, and to the free ends of these (3c, 4c) there are hinged, at their lower ends, two shaped plates (31, 32) which each, at a point of themselves located in some suitable intermediate position between the hinged points of the ends of said two short arms (3c, 4c), are additionally hinged to the outer ends of two mutually identical actuating links (91, 92) which at their own inner ends are hinged to the free end of the actuating arm (93) of a control lever (9), which is hinged in turn to the centre of the respective longitudinal member (21) of the

upper frame (2), which shaped plates (31, 32) are also provided, on respective segments situated a suitable distance inwards from where they are hinged to the outer ends of their respective actuating links (91, 92), with respective pluralities of notches for engagement on corresponding pins (95, 96) fixed integrally on said inner portions (3a, 4a) and also near the respective outer ends so that when said shaped plates (31, 32) are caused by said control lever (9) to engage their respective cavities on the respective pins (95, 96) they lock said outer portions (3b, 4b) and thus fix the upper frame (2) in the desired inclined position, and when instead they are caused, again by said control lever (9), to disengage from their respective pins (95, 96), they release said outer portions (3b, 4b) so that the latter can rotate freely about the respective hinged points of their inner ends and, being also able to slide their outer ends along the ends of the respective longitudinal members of the upper frame (2), the latter can also freely tilt into the desired position in which it can then be locked by causing said control lever to move said shaped plates (31, 32) in such a way that the corresponding respective notches engage on their pins (95, 96).

4. Device according to Claims 1 and 3, characterized in that said shaped plates (31, 32) being caused by the control lever (9) and corresponding actuating links (91, 92) to move in opposite directions such that the first shaped plate (31) is moved towards the centre of the structure while the second is moved away from it, will be differently shaped as appropriate, specifically: the first plate (31) will be generally V-shaped with two segments converging towards their lower hinged points where they are hinged to the free end of their arm (3c), the segment nearest the centre of the structure being hinged at its free upper end to the corresponding end of its actuating link (91) while the other segment, which diverges away from the first, is instead provided on its inner edge with the notches for engagement with the

corresponding pin (95) and the second plate will be generally triangular with two sides converging towards its lower hinged point where it is hinged to the free end of its arm (4c), one side, specifically that furthest from the centre of the structure, being the side at whose upper end it is hinged to the corresponding end of its actuating link (92) and the other side, adjacent thereto and hence nearest the centre of the structure, has notches on its edge for engagement with the corresponding pin (95).

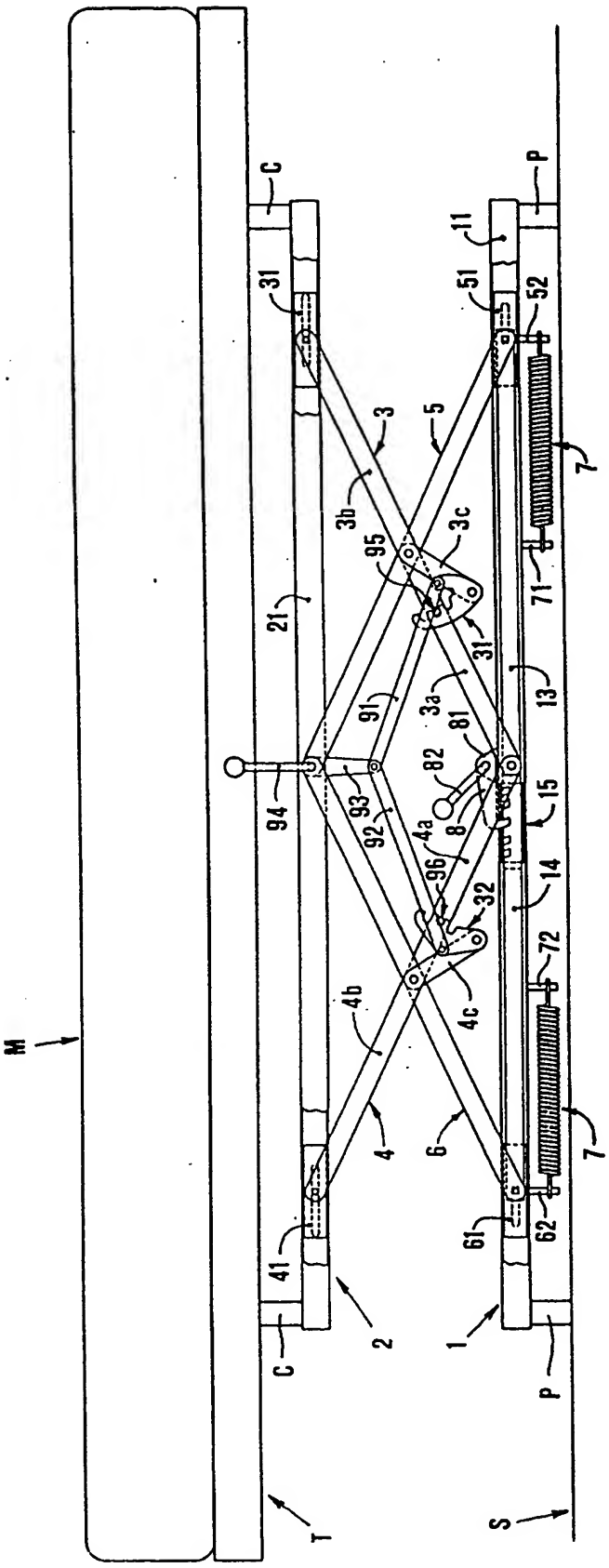
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Fig. 1

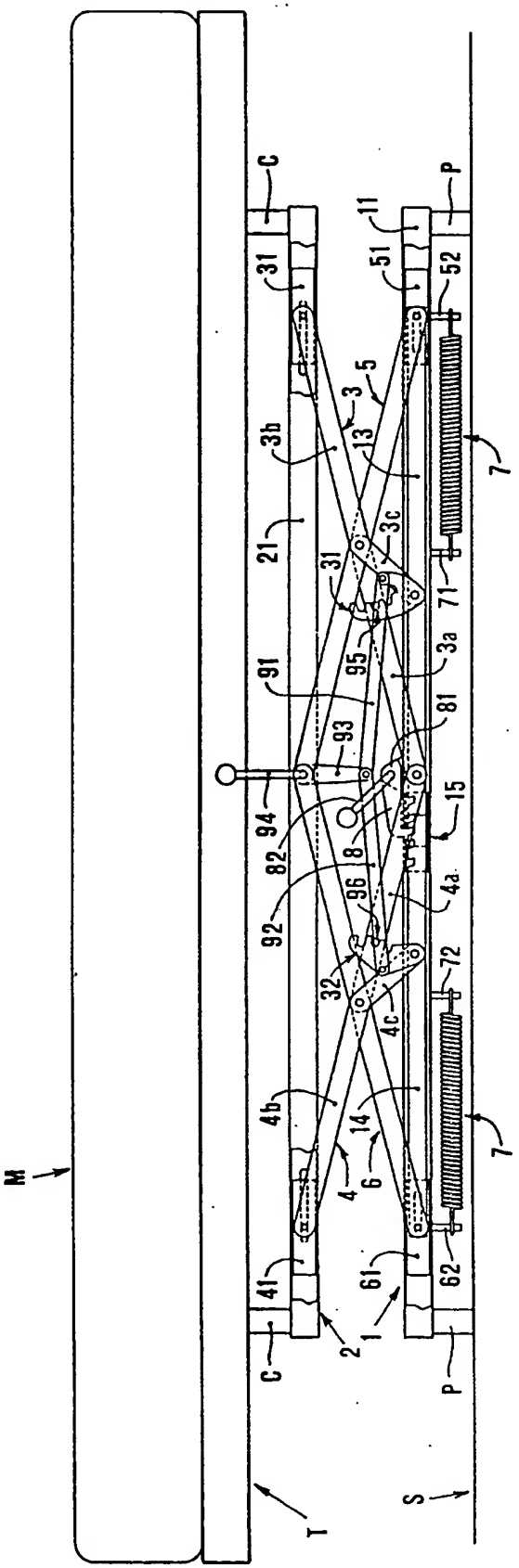
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Fig. 2

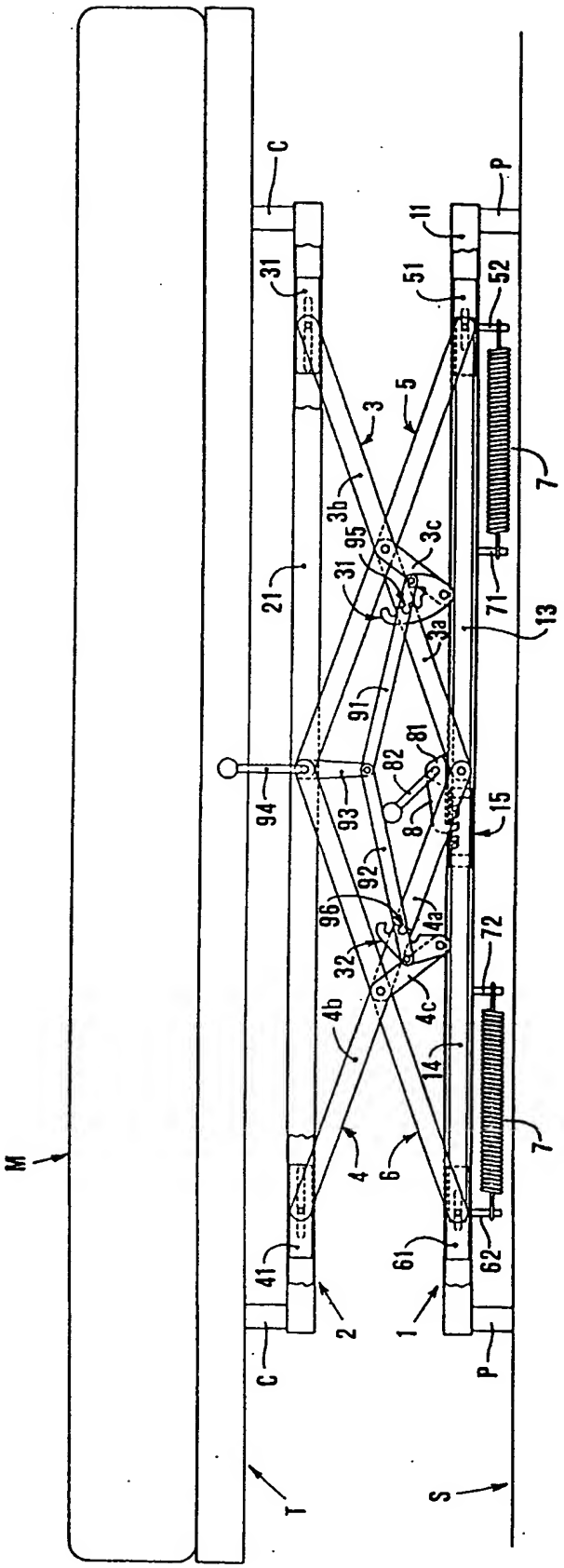
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Fig. 3

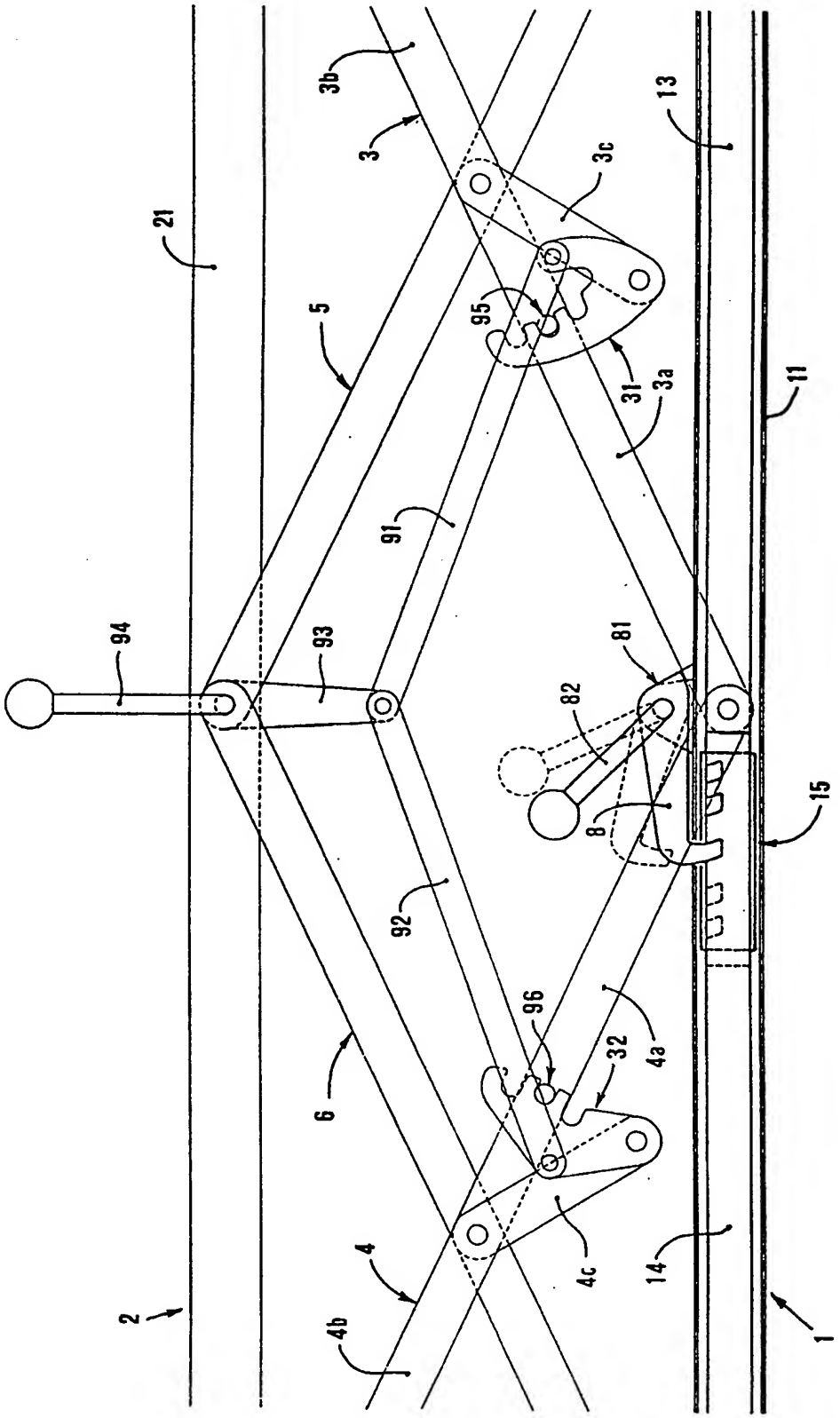

Fig. 4

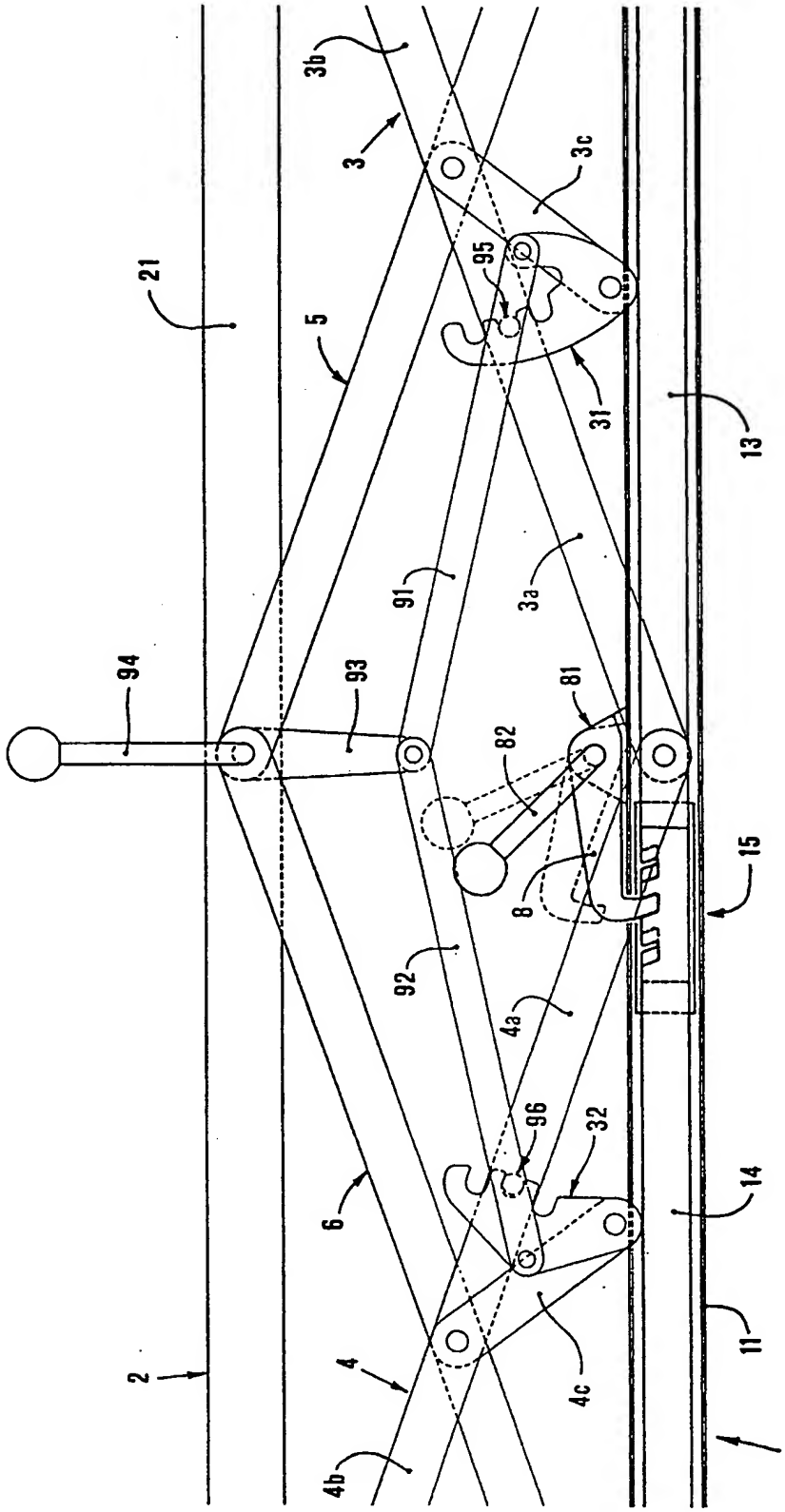

Fig. 5

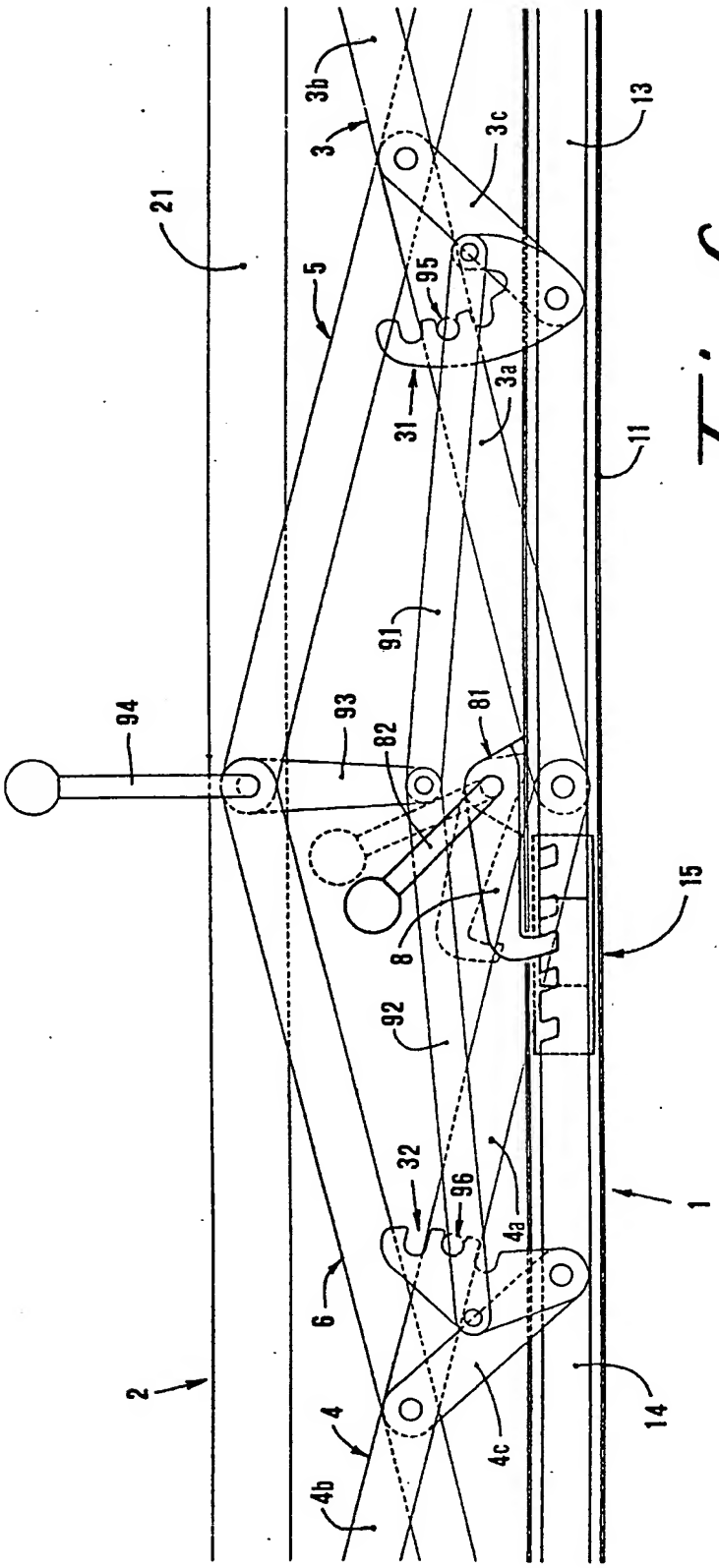

Fig. 6

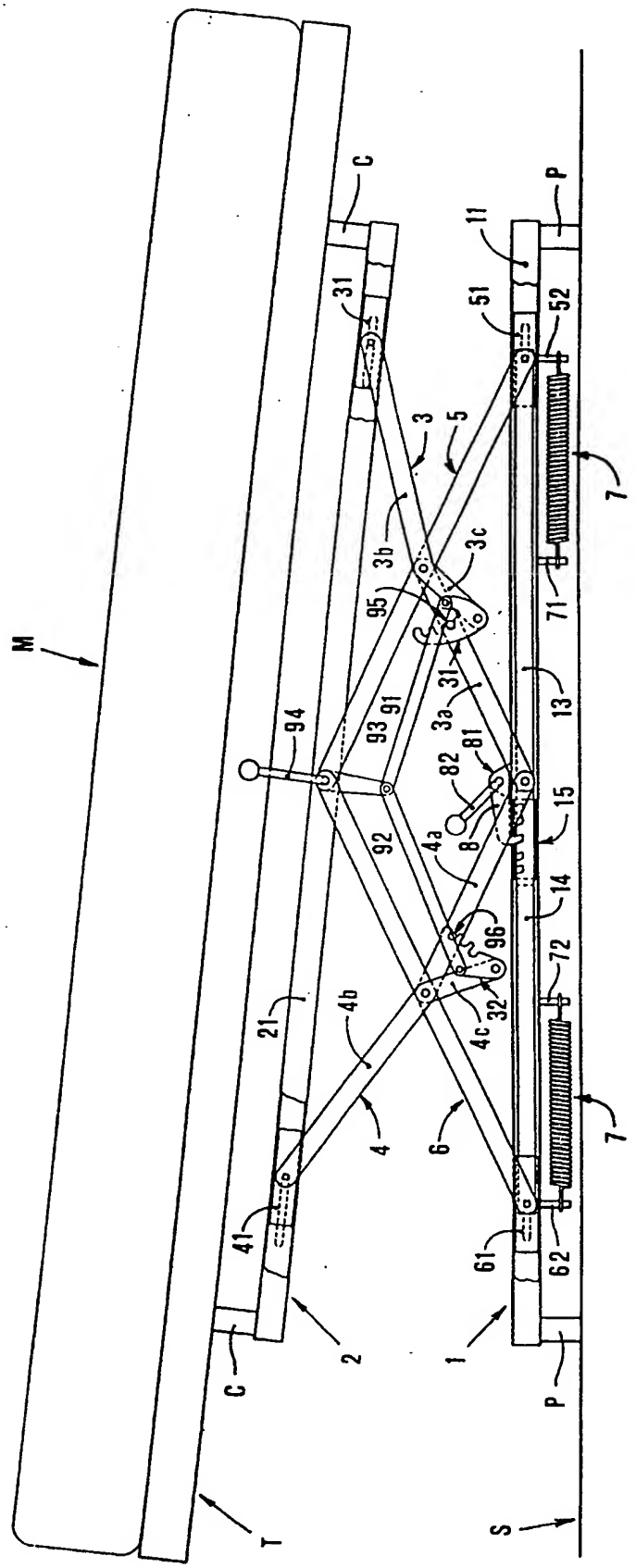
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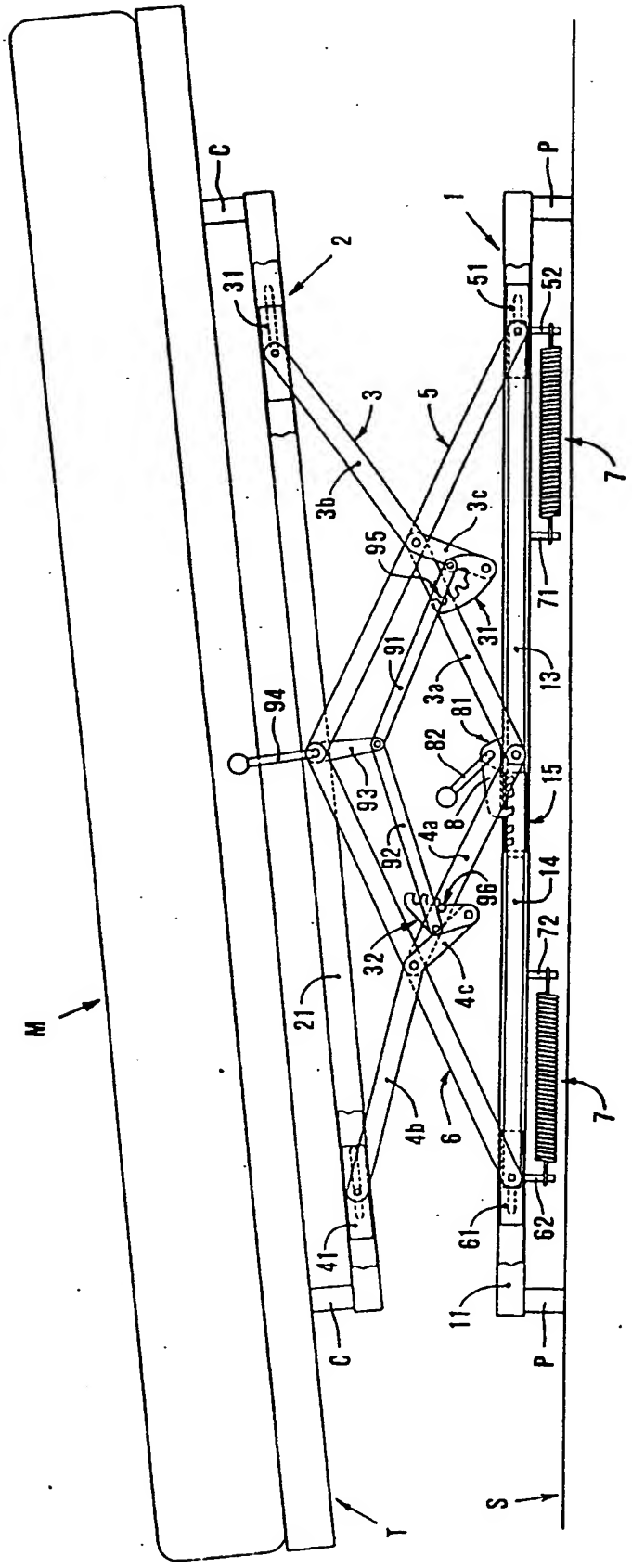
Fig. 7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1
2
31
51
52
3
5
3b
3c
7
95
71
91
31
13
3a
81
94
82
15
93
8
4a
92
14
96
72
32
4c
M
21
4b
6
7
61
62
41
11
C
P
S
T

Fig. 8

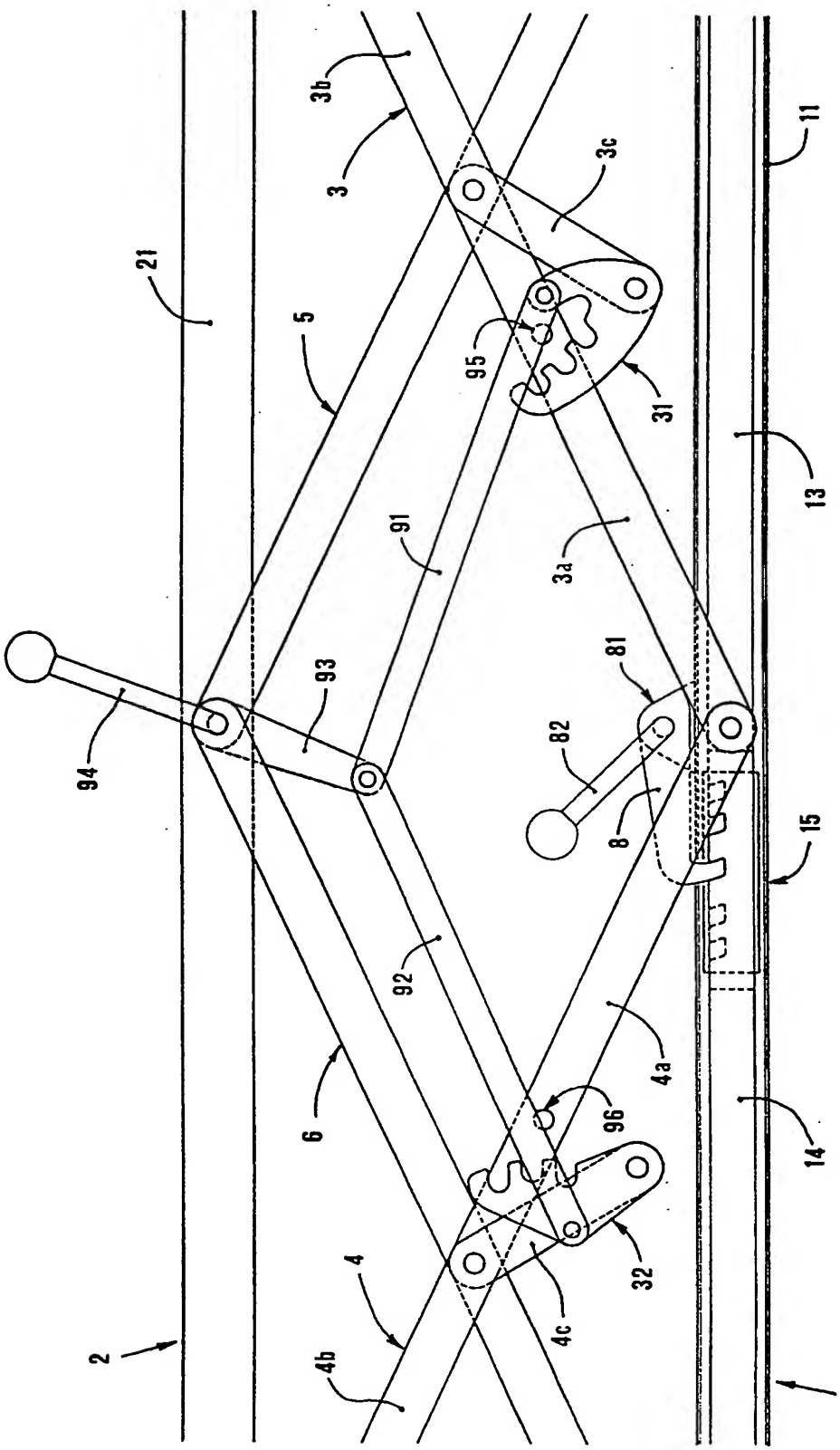

Fig. 10